

Developing New Image Registration Techniques and 3D Displays for Neuroimaging and Neurosurgery
Yuese Zheng¹, Kai-Wen Chiu¹, Dongcheng Jin¹, Sujay Chandorkar², Sarah Zajac³, and Emily Nicholson³
¹ Department of Electrical and Computer Engineering, Purdue School of Engineering and Technology;
Department of Computer and Information Science, Purdue School of Science;³ Department of Media Arts
and Science, IU School of Informatics

Image guided surgery requires that the pre-operative data used for planning the surgery should be aligned with the patient during surgery. For this surgical application a fast, effective volume registration algorithm is needed. In addition, such an algorithm can also be used to develop surgical training presentations. This research extends existing methods and techniques to improve convergence and speed of execution. The aim is to find the most promising speed improvements while maintaining accuracy to best fit the neurosurgery application. In the recent phase, we focus on algorithm speed up by translating the registration algorithm from Matlab into Java. Medical image volumes acquired from MRI scans and a depth map from the video data provided by Indiana University School of Medicine were used as testing images. Accuracy of the results from the translated algorithm is compared against the ground truth evaluated with mean squared error metrics. Algorithm execution time with and without the code translation is measured on standard personal computer (PC) hardware.

The 3D registered model is developed by the Informatics students to show the results of the speed improvements from the remaining students' work. Additionally, the surgical and preoperative data overlay will be presented in a 3D movie.

Our past testing indicates that an intelligent subset of the data points that are needed for registration improved the speed significantly but was still time taking. Preliminary results show that even though image registration in real-time is a challenging task for real time neurosurgery applications, intelligent preprocessing provides a promising solution. Final results will be available at poster presentation.

Mentors: Lauren Christopher, Department of Electrical and Computer Engineering, Purdue School of Engineering and Technology, IUPUI; Mihran Tuceryan, Department of Computer and Information Science, Purdue School of Science, IUPUI; Albert William, Department of Media Arts and Science, IU School of Informatics, IUPUI